

FEDERAL ADVISORY COMMITTEE ACT
CLEAN AIR ACT ADVISORY COMMITTEE
CLEAN DIESEL INDEPENDENT REVIEW PANEL

CHAIR: DANIEL GREENBAUM

DESIGNATED FEDERAL OFFICIAL: MARY MANNERS

Summary of the Panel's Meeting on July 30-31, 2002
Arlington, Virginia
DRAFT

I. OVERVIEW

The Clean Diesel Independent Review Panel (CDIRP) met on July 30-31, 2002 to discuss Panel members' comments on EPA's *Highway Diesel Progress Review* (EPA420-R-02-016/June 2002), hear presentations from refiners, the pipeline industry, and fuel marketers, and begin to draft an outline of the Panel's final report.

II. ACTION ITEMS

1. Drafting the final report. Dan Greenbaum requested that members of the Panel form two groups to draft the final report. He asked John Wall, Pat Charbonneau, Tom Cackette, Tim Johnson, and Rich Kassel to draft language for the PM filters and NO_x adsorbers section of the report. He asked Bob Neufeld, Mike Leister, James Kennedy, Mike Walsh, and Bill Becker to draft language for the desulfurization and fuel production sections of the report. Mr. Greenbaum will contrive a framework for addressing other issues unrelated to the Panel's charge. He also asked EPA's contractors (Rebecca Battye and Kathy Boyer, EC/R Inc.) to draft the introduction.
2. Additional Comments. Jed Mandel (EMA) will distribute written comments on EPA's report to Panel members well in advance of the September meeting. Dan Greenbaum requested that all other interested parties should submit their comments as soon as possible.
3. September Panel Meeting. The September 24-25, 2002 Panel meeting will take place at the Latham Hotel in Georgetown. Guest room reservations should be made by August 30, 2002. Panel members and observers should call 1-800-368-5922 to reserve rooms, and specify the Clean Diesel Independent Review Panel.

III. MEETING SUMMARY

Dan Greenbaum (Health Effects Institute; Panel chair) called the meeting to order. Members of the Panel, or their alternates, introduced themselves and identified the organizations they represent. Loren Beard (Daimler Chrysler) was an alternate for Josephine Cooper and Bob Leidich (BP) was an alternate for Tom Bond.

Mr. Greenbaum stated that the discussions in this meeting should not revisit issues in the June 2002 meeting, and emphasized that the Panel was not charged with revisiting the Highway Diesel Rule. He commented that any rule that affects fuels and/or vehicles raises complex issues, and the Panel cannot predict every decision-making point. While EPA should be made aware of the issues surrounding rule implementation, the Panel should not hold in-depth discussions of them. The meeting began with presentations from the fuels industry.

Presentations from the Refining Industry

- Mike Leister (Marathon Ashland Petroleum) gave the presentation “Fuels Industry Response to EPA’s CDIRP Progress Report.” He emphasized that all comments should be taken in the context of making sure the rule can be implemented. The industry does not wish to contest the rule, but it does want to ensure that the rule can be successfully implemented. The refining industry agrees with the report overall, and the report adequately covers the refining technology. However, the EPA report seems too optimistic; only positive results are reported and several issues unrelated to refining technology are not addressed. If parts of the fuel production and distribution system do not work (i.e., from the refinery, to the pipeline, terminals, and finally the fuel pumps), then the entire system will not work. He realizes the Panel cannot address these other issues and he has requested that EPA create a forum to address them. For example, EPA has not yet defined the nonroad diesel requirements, which are critical to refiners’ decision-making processes. If refiners will not be allowed to produce high-sulfur fuel in the near future, which will profoundly affect fuel production decisions. For example, in the summer, most refineries focus production on home heating oil.

Bill Gouse (American Trucking Associations) asked how many non-retail outlets existed for distribution (e.g., private fuel pumps for trucking fleets). Mr. Leister replied that he did not have that data, but perhaps the trucking industry would be able to provide more information.

Another issue that the fuels industry raised is sulfur measurement technology, both along the pipeline and at the refinery. Mike Walsh asked how ultra-low sulfur diesel (ULSD) was distributed in Europe, and how low sulfur levels were measured. Mr. Leister replied that in Sweden, ULSD is transported in dedicated pipelines and by tanker. Sulfur levels are measured at the refinery, and it is assumed that sulfur levels will not increase during distribution. Mr. Walsh asked if different measuring issues existed at the refinery and the pipeline in the U.S. Mr. Leister replied that the EPA requires downstream measurement for enforcement purposes, while many European enforcement regulations do not require downstream measurements. The fuels industry indicated that current downstream measurement methodologies exist but they are not robust and have a high margin of error. EPA is assuming that the industry will address measurement issues itself, as it has done historically with other fuel programs, but vendors are currently not actively addressing them.

Dan Greenbaum asked what levels of sulfur the refinery will produce, since the rule requires 15 ppm S at the fuel pump. Mr. Leister replied that most refineries are planning to produce seven ppm S, but if the measuring methods are inaccurate or have a high margin of error, the refinery may have to shut down for fear of producing off-specification (off-spec) fuel. Mr. Greenbaum commented that the problem could be either real contamination, or just error in the measurement methods. Rich Kassel (NRDC) commented that the rule does provide some protection from this scenario, in that it imposes a 15 ppm cap, but expects that real-world production will be seven ppm.

Paul Billings (American Lung Association) asked what currently happens to off-spec fuel. Mr. Leister replied that it depends on the sulfur levels of the off-spec fuel. Currently, off-spec fuel can be blended into high-sulfur diesel, but in the future, refineries will have to shut down until the source of contamination is fixed. A small amount of off-spec fuel could contaminate an entire batch of ULSD.

Refiners protect low sulfur gasoline by “wrapping” the batches with high-sulfur gasoline, then diverting the transmix to a high-sulfur gasoline pool. Transmix between gasoline and diesel is cut out of the system. Pipelines establish a sequence of batches in order to minimize the amount of transmix produced. Terminals determine how much of the different products they want (“nominations”). The quantity is adjusted based on the nominations. Supply and demand are decoupled from the refinery process, but refineries must still pay attention to market demand so they can maximize fuel production efficiency.

Bill Becker (STAPPA-ALAPCO) said the refining industry should identify which issues were raised in the rulemaking and discarded or invalidated, and which issues were addressed in EPA’s technology review under the rule. The issues that have already been addressed and/or litigated should not be discussed at all. Mr. Walsh agreed, saying that nothing in the fuels industry presentation covered desulfurization technology and did not help the Panel to answer questions 3 and 4 in its charge.

Dan Greenbaum replied that if the Panel is going to list other issues that should be addressed in the near future, the presentation is helpful in identifying them. The issue of sulfur testing is an appropriate technology question. Mr. Leister added that most of the issues he has presented were not addressed in the review, and those that were should be revisited. He indicated that EPA does not understand the severity of the problems that these issues could create. Chet France (EPA) commented that most of the issues raised in the presentation are implementation issues, and may be addressed by the upcoming workshops. Mr. Leister replied that the format of the workshops was not conducive for addressing these types of issues. He stated that the general workshop format involves a presentation by EPA followed by a question and answer period for the industry. However, the issues raised here require negotiation between EPA and the industry. Mr. France said that he would appreciate a follow-up discussion with Mr. Leister to determine what type of forum is needed to address these issues.

Rich Kassel asked if the refining industry needed a regulatory process to deal with distribution issues, or if the industry could solve its problems without regulatory intervention. Mr. Leister replied that the ultra-pure nature of the new fuel made the situation unique. The industry will eventually find a way to distribute ULSD, but the transition may be difficult.

Rich Kassel commented that the Panel is spending too much time discussing issues unrelated to technology, and not enough time working on the final report. He added that the NRDC also has a long list of issues that should be addressed, but he did not bring them to this Panel. Pat Charbonneau (International Truck and Engine) said that issues related to rule implementation should at least be listed.

- Bob Schaefer (BP) gave the presentation “Diesel Sulfur Test Methodology.” The rule’s designated test method for measuring sulfur in ULSD is ASTM D 6428, and the alternate test methods are 5453 and 3120. The designated method for measuring sulfur in 500 ppm fuel is ASTM 2622. Europe and California use 2622, 5453, and 3120 to measure USLD. A large round robin, which included 92 labs and 5,632 data points, was organized to evaluate the test methods. The results showed that ASTM D 6428 had the highest margin of error in both repeatability and reproducibility, while ASTM D 5453 proved to be the most precise method.

Mike Walsh asked if some labs were less precise than others, and if those results were eliminated from the data analysis. Mr. Schaefer replied that the results were coded to preserve the labs’ anonymity, but the analysis did remove outliers, so the final numbers are robust. He acknowledged that imprecise labs could cause problems. Tom Cackette (ARB) asked if the results included a cluster analysis to determine if outliers were dominated by a few labs. Mr. Schaefer replied that he was not involved in the data analysis, but he is confident that the dataset has been thoroughly analyzed by every statistical test pertinent to a round robin.

Dan Greenbaum commented that the presentation was informative, and that the round robin was a good example of new data that had been produced since the rulemaking. Mike Walsh asked if the new data would be available to EPA. Margo Oge (EPA) confirmed that EPA will analyze the data and decide if ASTM D 6428 was indeed an inferior method and will change the rule to allow 5453 as the designated method if EPA agrees with these conclusions.

Bob Neufeld (Wyoming Refining) commented that changing the test method to 5453 would not solve the problem of testing for sulfur levels in the pipeline. Method 5453 is used in the refinery labs, and the industry needs a quicker, on-site test.

Tim Johnson (Corning) asked what biases might be introduced by the error in test methods. For example, if a sample is 10 ppm sulfur, but the test measures five ppm,

refineries will ship the fuel with no further testing. However, if the same sample tests at 17 ppm you won't ship? Mr. Leister responded that the decision to degrade fuel happens based on one analysis. As soon as the S is higher than 15 ppm they lock down the tank and disrupt the process.

Mary Manners (EPA) asked if different labs used equipment manufactured by different vendors for a given test method and, if so, did the various equipment types for a given test method yield similar or different results. In other words, is there equipment-to-equipment variation for a given test method and how is that reflected/accounted for in the results. Mr. Schaefer replied that in some cases, more than one lab tests the fuel, but each vendor must meet ASTM standards to be certified.

Bill Gouse asked what additional downstream methods are being used to measure sulfur. Mr. Schaefer replied that there are currently no methods available, but one method is being developed for pipeline measurements.

- James Kennedy (UOP LLC) gave the presentation “The Lower It Goes, The Tougher It Gets! Practical Implications of Producing ULSD.” He presented information on sulfur species found in fuel, and the issues surrounding removing sulfur to produce ULSD. Refineries must decide whether they can revamp their existing system to produce ULSD, or if new equipment is needed. If the refinery has the capacity, it could simply add more active catalysts to the reactor, and introduce different fuel feeds. However, if those additions do not eliminate enough sulfur, the refinery must add a new reactor and a new hydrogen sulfide (H₂S) scrubber. The refinery must also ensure that the stripper to remove the H₂S can handle up to 10 times as much volume. One option for removing sulfur is introducing hydrogen into the fuel. However, as hydrogen is added, the density of the fuel decreases, thus decreasing fuel economy. The overall conclusion is that the technology for producing ULSD exists and is improving, but it may be costly for the refinery to incorporate the technology.

Bill Gouse asked if refineries had quantified the decrease in fuel density as a result of adding hydrogen. Mr. Gouse also commented that there was no discussion of lubricity issues. John Wall (Cummins) said that fuel pumps are currently lubricated by the fuel, but additives must be added to ULSD for lubricity. Jet fuel has been using additives for years. Mike Walsh commented that many additives were available to enhance lubricity in fuel. Mr. Leister replied that additives are available, but adequate methods to test them do not exist. Pat Charbonneau added that engines are robust, so developing tests has been a low priority.

Dan Greenbaum asked refiners when they would begin working with specific companies to install technology. Mr. Kennedy replied that some refineries are working with companies, but cooperation between companies is largely dependent on cost. Refineries are struggling with the unknowns of the future, i.e., how much ULSD they should make, and

future requirements for off-highway diesel and home heating fuel. Bill Gouse asked what deadlines the refineries were facing in order to produce ULSD on time. Mr. Kennedy replied that different companies are operating on different schedules. Mr. Leister added that timelines depended on where the refineries were in their turnaround schedule. All refineries undergo a major systems overhaul every 4-5 years. Refineries that need an overhaul in 2004 will probably modify their systems earlier so they do not have to shutdown the refinery twice in two years. Mr. Kennedy commented that there is a large uncertainty in the investment that refineries will have to make; refineries may have to invest up to \$10 million, and the fabricating industry projects the refineries may need to invest \$16 billion in steel alone (for new reactors).

Bill Gouse asked about fuel flow in cold climates. Mr. Kennedy said that in the northern states, kerosene is used in diesel fuel to increase flow. Since kerosene currently has high sulfur levels, which may have to be reduced in the future to ensure that the kerosene/diesel blend meets the 15 ppm S specification, the fuel will be enriched with additives in the future. In addition, ULSD will have fewer aromatic compounds, which also reduces flow.

Rich Kassel asked about the cost benefit in converting all fuel production to 15 ppm, including off-highway diesel. Some refineries are looking at that option, and are leaving plot space for more desulfurization equipment. Dan Greenbaum commented that synchronization between nonroad and on-road fuel would be beneficial, but nevertheless decisions must be made with uncertainties in these areas. Bill Becker commented that his Association agrees with the proactive steps some refineries are taking to develop ULSD for on-road and nonroad distribution. Mike Leister clarified that refineries do not want to develop both on-road and nonroad programs simultaneously, but they do want to know as soon as possible what the nonroad specifications are going to be. Mr. Kennedy said existing equipment may not fulfill the capacity requirements needed to produce large amounts of ULSD or ULSD from the most difficult feeds.

- Dennis Kidd (Phillips) gave the presentation “Reducing Diesel Fuel Sulfur with Phillips S Zorb Technology.” This technology removes sulfur from fuel without significant consumption of hydrogen. The technology is a fluidized bed reactor that can be added to existing equipment. Lubricity is only slightly affected with this technology, and it has the side benefits of reducing hydrogen consumption and NO_x, and CO₂ emissions by eliminating the need for hydrotreating. A pilot plant in Addison, Texas has tested the equipment, and the results are positive. They are producing 15,000 bbls per day, which meets the Houston demand, and the data from the refinery are available. Phillips is currently in the design phase of a demonstration unit at the Sweeney, Texas refinery. The equipment can be used to revamp an existing facility if there is sufficient space in the refinery. The costs for the S Zorb SRT process are similar to hydrotreating costs.

John Wall asked if high temperatures created a problem for hydrogen consumption in the fuel. Mr. Kidd replied that if temperatures are too high, carbon chains will become unsaturated, and aromatic carbon rings will form and the hydrogen will be released.

Tim Johnson asked if this technology could be used at the terminal. Mr. Kidd replied that terminals generally do not possess the expertise (e.g., safety) necessary to implement the technology. They also don't have the infrastructure (utilities) and there would probably be permitting issues. It is also difficult to ship units to terminals because of their remote locations.

- Michael Ackerson (Process Dynamics) gave the presentation "IsoTherming Technology." IsoTherming technology introduces hydrogen more efficiently by increasing its partial pressure. This technology has an added advantage of increased nitrogen removal. The first commercial operation will produce 4,000 bpd, and will come online September 3, 2002. The capital costs are about half of the cost of hydrotreating, the operating costs are unknown but may be negative (because less hydrogen is needed), and the cost per gallon of fuel is unknown. In some cases, refineries may receive a payout from implementing the technology.

Dan Greenbaum asked if the process would result in increased hydrogen consumption. Jon Skeds (Process Dynamics) replied that every technology except the S Zorb will experience increased hydrogen consumption, but there are currently not enough data on this technology to quantify the increase.

Discussion of Panel Members' Comments on EPA's Report

The Panel discussed comments received on EPA's report. John Wall commented that testing technology is not adequately addressed in the report. Dan Greenbaum agreed and asked for clarification in the report on the testing issue. Variability is currently too high when testing NO_x and PM, and tests need a finer resolution. The experience in developing testing technologies lies in the light-duty (LD) sector. Heavy-duty (HD) trucks get far less fuel economy than LD vehicles, and they consume much more fuel, so more sulfur will be pushed through PM filters and NO_x adsorbers. There is concern that the transition from the LD sector to the HD sector will be difficult. Bill Gouse agreed, saying that fuel and tailpipe testing methods should be addressed.

Bill Gouse commented that Section 3 of the report *Progress Review of Desulfurization Technology* was presented clearly, and he especially appreciated the timetable (Figure III.3 on page 69). A similar timetable for the engine side of the review would be helpful, especially with developers facing deadlines within the next year. Dan Greenbaum noticed a lack of parallelism between the review of the engine technology and fuel production. Chet France replied that much of the engine-side issues, including a timetable, were addressed in the rulemaking. He agreed that the next 12 months will be critical for technology development.

Mike Walsh suggested that the Panel focus on the four questions in the charge.

Question 1: PM Filter Technology Progress

Mike Walsh commented that all of the data presented to the Panel and in the EPA report suggests that filters are progressing at a sufficient pace to meet the 2007 deadline for both new and retrofit applications.

Pat Charbonneau commented that this technology still needs solutions for active regeneration and ash handling.

Question 2: NO_x Adsorber Technology Progress

Mike Walsh commented that NO_x adsorbers have not progressed as quickly as PM filters, but there has been significant progress. He feels that sufficient progress has been made to meet the 2007-2010 implementation timeframe.

Dan Greenbaum commented that industries do not expect full implementation of this technology this year. He asked where the next steps of progress for NO_x adsorbers would take developers, and if there was a history that could be compared with this development.

- Mike Walsh replied that in the early 1970s, large uncertainties about durability and contamination existed for unleaded gasoline production. Technology developers have an advantage with ULSD production, because they now have more than 25 years of experience with post-combustion technology, and they are in a better position to evaluate technologies. Tom Cackette added that in 1975, there were many unknowns with integrating engines with aftertreatment technology. Today, experts have much more experience.
- Bill Becker said another example occurred in the mid-1980s, when the Northeastern States banded together to decrease fuel volatility. Critics predicted fuel shortages, long lines, and a price increase, but the technology was instead cheap, easy to use, and fuel remained plentiful.
- Marc Goodman (consultant, speaking on his own behalf at the end of the day on July 30, 2002) gave several negative examples of technology forcing rules. The first generation of stage II vapor recovery encountered many problems, and the only two states that initially implemented the program were California and D.C. Second, evaporative control systems worked well for certifications, but the system failed after 10,000-15,000 miles and many emissions went undetected. Third, the introduction of unleaded gasoline resulted in higher emissions of butane that then had to be regulated again. He also cited examples of reformulated gasoline and MTBE and early experiences with alternative fuel vehicles. He concluded that

demonstrating progress does not necessarily ensure successful implementation. Developers may have to resort to inferior technologies at the beginning of the program simply to meet implementation deadlines.

John Wall commented that the EPA report should make the distinction between technology development and product development. There is still much work to be done before NO_x adsorbers become a marketable product. Pat Charbonneau commented that bench-scale testing of this technology has been done in the lab and on dynamometers, but it has not yet been integrated into vehicles.

Question 3: Refiners' Plans for Producing ULSD

Mike Walsh commented that there is no question that existing technologies can produce ULSD, as refineries are already moving toward introducing the fuel into the market.

Question 4: Desulfurization Technology Progress

Mike Walsh commented that this technology has progressed faster than expected, and he feels that sufficient progress has been made to achieve the implementation deadline. Bob Neufeld agreed, but he is concerned that the technology will not progress in a timely fashion. Mr. Kidd's presentation indicated that 2004 would be the earliest time the product would be commercially available, so refiners would have less than six months to make business decisions. Bill Becker clarified that Phillips has accelerated the schedule and the technology could be online as early as 2003.

Rich Kassel commented that even the optimistic experts could not predict that the technology would progress as quickly as it did. At a very early stage in the rule implementation there is agreement on which technologies will be used.

Discussion of Observers' Comments on EPA's Report

- Jed Mandel (EMA) gave the presentation "Path to 2007: EMA Comments on EPA's June 2002 Highway Diesel Progress Review." EMA has not submitted written comments. They expect to submit written comments on the EPA report in advance of the next meeting. He presented progress on PM filters and NO_x adsorbers using the "Framework for Assessing Feasibility" color chart presented at a previous Panel meeting. PM filter technology has progressed further than NO_x adsorbers, shown by "green" areas in emissions and performance; NO_x adsorbers still have many "red" areas, where no solution currently exists. Overall, he concluded that progress has been made, but many uncertainties lie in both technologies. The true test of progress is whether it is commercially available. He requested that EPA review the status of progress again in mid-2003.

Mike Walsh asked when the cutoff would be for accepting written comments on EPA's report. Dan Greenbaum replied that he did not want another comment period, but he would extend the deadline for comments.

Bill Becker commented that the rule allowed for a 4-year phase-in of NO_x adsorbers, so developers would still have time to improve it. Mr. Mandel replied that adsorbers still need to work at 50-70 percent efficiency by 2007.

Paul Billings asked if PM filters were currently being sold. Pat Charbonneau replied that they were on the market, but durability and active regeneration issues still have not been solved. PM filters have mostly been installed on school buses, so durability of 435,000 miles is not as much of a problem.

Bill Becker asked for clarification of the red, yellow, and green indicators of progress. Bruce Bertelsen (MECA) also expressed concern that the description of the colors portrays a more negative picture than necessary. Mr. Mandel explained that a yellow indicator implied that the area of progress was well on the way to green, and a red indicator did not imply that the problem was unsolvable. John Wall added that green indicators implied that the technology was robust enough to work in all climates and under all circumstances. Dan Greenbaum commented that the media should report with caution—technology is not “hunky dory,” but there are also no showstoppers that have been identified. Tom Cackette recommended that the description on the red indicator be changed so that it does not say “No Solution.” Mr. Mandel replied that EMA would correct the wording.

Mike Walsh asked if EMA agreed that progress had been made on NO_x adsorbers, even though many issues remain unsolved. Mr. Mandel replied that they did agree with the EPA report, although they felt the report was too optimistic.

Mike Walsh asked about the Infrastructure category on the Framework For Feasibility chart for NO_x adsorbers. John Wall replied that in the beginning, it was used to indicate the progress of a support system for distributing a second fluid, like urea, for selective catalytic reduction (SCR).

Bruce Bertelsen asked about the Maintenance category for NO_x adsorbers and PM filters. The main problem with PM filters is ash accumulation, and he asked if the specific problems for adsorbers included reliability or useful life.

Rich Kassel commented that EMA does not seem as optimistic about technology progress as the EPA report. He expressed concern that EMA represented the lowest common denominator of all the companies in the organization, and that the red areas of progress indicated that some companies really had no solutions. Mr. Mandel disagreed, saying that the colors were not driven by the lowest common denominator. There are hundreds of

different truck types and applications, and the colors indicate the worst-case scenario. Dan Greenbaum added that there are different market segments, and while the presentations captured the majority of progress, it failed to show what percentage of the market needs work.

Bill Gouse clarified the definition of “useful life.” According to the rule, PM filters must have a useful life of 435,000 miles for the emissions standard, but that is not the useful life of the engine. Most HD vehicles last for at least 900,000 miles.

Panel members discussed the need for an additional progress review. The rule provides that a review will be conducted every two years, but Mr. Mandel thinks the review should be sooner, as 2003 will be a critical year for progress. Bill Becker commented that introducing another review is unfair to the states. The states need to develop their State Implementation Plans (SIP), it is time to move on. Chet France commented that EPA recognized that next year will be critical to development, so they will begin another review at that time, but they will not require additional reviews for states.

Paul Billings expressed concern that any additional progress reports EPA produced would be at least six months out of date. Bill Becker added that the best kind of report is to tell the press about progress. Bruce Bertelsen said, and Mr. Mandel agreed, that EPA agreed to monitor progress, but not to necessarily produce a report. Companies will begin selecting technologies next year, and will then begin product development.

- C.K. Salter (Mack) gave the presentation “Mack Powertrain’s Comments on 2007 Feasibility.” Mack currently provides 17 percent of Class A HD vehicles. Mr. Salter presented a timeline for engine production including the development process to achieve the 2007 standards, and a review of the progress of systems integration for PM filters and NO_x adsorbers. In general, Mack agrees with EMA’s conclusions. He also discussed SCR with urea as a reductant as an alternative technology for NO_x reduction. Europe is planning pilot production of this technology in 2005. Issues still remain with the infrastructure distribution of urea, but it is currently the technology of choice. Dan Greenbaum commented that some tests have been conducted that use fuel as the reductant instead of urea. Mr. Salter replied that these tests have shown that fuel is much less effective.

Drafting the Panel’s Report

Panel members discussed how to proceed in writing the final report. Panel members debated whether to hear presentations on issues unrelated to the Panel’s charge, or to spend more time drafting the report. Bill Becker recommended, and several members agreed, spending a significant portion of this meeting trying to reach an agreement on the tone and the language of the report, instead of discussing issues that are not in the Panel’s charge. Mike Leister disagreed, saying that he could not produce a report that did not at least list the other issues. Bill Gouse

added that his impression was that the Panel wanted to hear the other issues, and he felt it would be beneficial to hear presentations of these other issues. Alan Wright (Pilot) said that from a retailer's point of view, these issues could be dealt with EPA directly, but he would like some education on pipeline and terminal issues. Rich Kassel commented that everyone on the Panel, including NRDC, has other issues that they would like to address. However, these issues could rob the Panel of time to address the issues in the charge. John Wall suggested a compromise of working on the report first, then hearing presentations later.

Panel members discussed the "straw" outline that Dan Greenbaum constructed. He also requested that two workgroups form to draft the other sections of the report. He asked John Wall, Pat Charbonneau, Tom Cackette, Tim Johnson, and Rich Kassel to draft language for the PM filters and NO_x adsorbers section of the report. He asked Bob Neufeld, Mike Leister, James Kennedy, and Mike Walsh to draft language for the desulfurization and fuel production sections of the report. Bill Becker and Paul Billings expressed their concerns that environmental and/or State organizations were not involved in the drafting process for this section. Bill Becker was then included in the workgroup. Mr. Greenbaum said that he will attempt to contrive a framework for addressing other issues unrelated to the Panel's charge.

The Panel members provided the following responses and reactions to the Charge questions.

1. *What is the current status of the NO_x adsorber technology to meet the provisions of the HD2007 regulations given diesel fuel with a sulfur cap of 15 ppm? Is industry making progress to develop NO_x adsorbers in a timely manner? Are the necessary resources and plans being put in place to ensure that the technology is available in 2007? What other engine technologies are being pursued/developed to enable or facilitate the application of NO_x adsorbers?*

Pat Charbonneau reiterated that the velocity of progress in this area is high, but it is not as far along as PM filters. NO_x adsorber testing has only occurred on bench and chemical tests, and dynamometers whereas PM filters are already on vehicles. The next step is to introduce NO_x adsorber technology into vehicles. Margo Oge added that adsorbers have begun to be integrated more into light duty vehicles (e.g. Toyota, although that integration has not been certified), but not yet on heavy duty vehicles. John Wall added that PM filters have engineering issues, where NO_x adsorbers have technological issues (migration of precious metals, sulfur regeneration, deterioration of the substrate, surface behavior, etc.) that have yet to be resolved. There may still be fundamental barriers in developing these systems, and these barriers should be specifically identified and addressed. While progress has been made in durability (e.g., 100 hours of successful operation versus 3 hours), fundamental issues still need resolution (the target is 10,000 hours of durability). Paul Billings asked if it is helpful to compare PM filter progress with NO_x adsorber progress, or should the Panel focus on the two technologies separately and not try to compare apples with oranges? Tim Johnson asked if NO_x adsorber progress where it should be now? The general consensus (as presented in the MECA presentation) is that the technology is on track, even though fundamental problems still remain. Numerous progress reports exist from

all companies that are developing adsorbers or parts of adsorbers. The probability of success with the remaining issues is a continuum, with LD vehicles being more successful than HD— The Panel has not been charged with assessing LD vehicle progress, but the HD side may be able to learn from progress in LD vehicles. It was noted that “Problems” are characterized more negatively, while “issues” can be positive—the report should distinguish between the two. The challenges in NO_x adsorber development are not “doomsday” scenarios, but the issues have been identified and are being overcome.

There was a discussion of the development timeline. Tim Johnson said the timeline for NO_x adsorbers has phase-ins at 90 percent efficiency for 2010, so companies have more time and flexibility to optimize the system. Meeting a 0.1 fleet average may only require 40 percent efficiency in the adsorber (the rest of the reduction may be achieved with engine technology). The EPA report indicated a 50 percent phase-in of the 0.20 standard by 2007, but the Panel’s report could indicate that this may not be necessary. Japan is controlling emissions with engine control technologies in order to achieve its standards. In the U.S., as aftertreatment technologies improve, engine-out emissions may not need to be controlled as much, and fuel economy will also improve. Pat Charbonneau and John Wall disagreed. In order to achieve 0.2, they’ll need 90-95 percent efficiency. Mike Walsh said the manufacturers will be working on fundamental combustion to meet the target. John Wall added that after treatment is allowing for better fuel efficiency by recalibrating the engine for higher engine out emissions. Loren Beard (Daimler Chrysler) reminded the group that the timeframe for LDVs is 2004. He would not characterize to his management that NO_x adsorbers are ready to go and stated that the Toyota vehicle has not been certified.

In summary, Bill Becker stated that this section should reflect a tone consistent with the EPA report—p77 (conclusions) NO_x adsorbers are improving at a rapid pace, and we are confident that they will be available by 2007—and the MECA presentation conclusions. The Panel is assessing a snapshot of the technology, and while issues still remain, no one has disagreed with the conclusions presented in the EPA report or the MECA presentation. John Wall responded that his personal reaction is that the EPA report is very optimistic. The Panel’s report should indeed balance the good news with the unresolved issues. There are no showstoppers, as in nothing prevents adsorbers from being successful now, but that does not mean that showstoppers will not surface in the future. NO_x adsorber progress is positive, but there should be caveats that issues still remain. James Kennedy added that the last meeting left a very positive image, but it is not a done deal. Pat Charbonneau added that the industry cannot say “It can’t be done” due to the dramatic progress. He added that there is also optimism that progress will continue and that this isn’t the time to say we have 100 percent confidence it can be done.

2. *What is the current status of catalyzed diesel particulate filters to meet the provisions of the HD2007 regulations given diesel fuel with a sulfur cap of 15 ppm? Is industry making progress to develop the catalyzed diesel particulate*

filter in a timely manner? Are the necessary resources and plans being put in place to ensure that the technology is available in 2007?

Tim Johnson said in general, filters are available. They have been developed and retrofitted for 20 years. Progress over the last two years has been impressive stimulated by LDV in France. There are several regeneration strategies emerging. However, remaining issues include ash handling, and regeneration under all conditions. Pat Charbonneau added that passive filters perform when used at the right conditions. However, all vehicles will need active regeneration strategies; all organizations are focused on this. Other issues for PM filters are fuel-related. Mike Leister added that the filters already meet the standards. Rich Kassel added that there is industry-wide agreement that active filters are the technology choice. International engines are certified at the 2007 standard. Filters are being used in retrofit applications (e.g. school buses and for medium heavy-duty engines up to 185,000 miles). Examples should be included in the report. Mike Walsh agrees there is a worldwide movement toward filters (Europe and Japan adopted 2005 standards).

John Wall reiterated that the EPA report under-emphasizes the need for active regeneration. The report needs to recognize differences between technology development and product development. Progress needs to occur for durability. Tom Cackette said many filters in Europe have survived 435,000 miles. The ash issue still exists. The high-end experience in Europe is 600K km, which approaches the useful life of the filter. Bruce Bertelsen said in a full range of applications, active regeneration is a back-up. Pat Charbonneau disagreed, saying active regeneration is a fundamental strategy for all diesels.

Tim Johnson said the most active area of research is integration of systems with NO_x adsorbers and PM filters—entire systems integration. Bill Gouse clarified that half a million miles is not high-mileage for a heavy duty truck. Engines are overhauled at 900,000 miles and the body typically dies after a couple million miles. Pat Charbonneau responded that the lowest total cost of ownership is the price they sell to. In responding to a comment that first cost is a major issue, Tim Johnson said it is a matter of negotiation, addressed through long-term contracts, partnerships, etc. (cost will not be discussed in detail, however). There are numerous alternatives – there is competition and there are filter alternatives. The EMA presentation outlined several issues that should not be ignored—the Panel should take into account issues addressed by other manufacturers, e.g. fuel economy. Bill Becker asked if any of these issues - cost & fuel efficiency - are preventing or interfering with the technology development? Pat Charbonneau and John Wall responded that first cost is a point of systems integration—producing an integratable filter at lowest cost is an objective of the design process. Cost does not interfere with the technology development, nor is it a showstopper, but it is a factor in assessing technology alternatives. John Wall emphasized that to get a low cost, you need to get it right in the design phase. Design integration needs to be done in a year. Major elements can't shift. Paul Billings reminded the group that the Panel does not have the confidential business information (CBI) to assess cost. John Wall stated that industry is very close to having a product in 2003, and is very focused on the remaining issues.

Tim Johnson said that emissions measurement for these very low emissions still remains an issue. Emissions measurement is being developed significantly, however, there needs to be a consolidation of methods (this applies to NO_x also). Margo Oge added that EPA has the equipment, and EPA has been working with EMA on test procedures. In the past, technical amendments to rules have been identified and implemented throughout this process.

Rich Kassel made a general note that the report should emphasize both good news and remaining concerns equally. It takes more page space to explain unresolved issues than it does to say “progress has been made.”

Mike Walsh said the report should emphasize that the technology is being evaluated at mid-2002 which is early for technology decisions and product introductions.

3. *Which refiners have announced their plans for producing low sulfur diesel fuel by June, 2006? Where are refiners in their decision making/planning process for complying with the low sulfur diesel program requirements? Are the necessary resources and plans being put in place to ensure that refiners are on track for meeting the 15 ppm sulfur diesel standard in 2006?*

Mike Walsh began the discussion by saying technologies exist for desulfurization, and some refiners have made plans to implement these technologies. Methodology alternatives are still being assessed, but there are no technological impediments. The methodologies are dependent upon the crude used and the products developed. Some advanced technologies are emerging that may enable small refineries especially to achieve ULSD levels. James Kennedy clarified that these emerging technologies and lower costs are for revamped units, however. The Phillips technology hasn't been demonstrated as a new unit. Bob Neufeld added that page 73 of EPA's report indicates that 12.8 percent of the volume will comply by 2006. However, 87 percent of the diesel-producing refineries have not yet made decisions, some due to non-technology related issues that will not be addressed by the Panel (e.g., New Source Review and enforcement cases could influence whether these refineries choose to make ULSD). However, the percentage that the Panel would expect to have made decisions at this time cannot be determined. Bill Becker added that the conclusions in the EPA report (p77-78) for the refining industry state that refiners are where EPA expected them to be, and some are ahead of schedule (some will make a significant volume of fuel as early as next year). In terms of the Panel's charter, these conclusions seem to be fair, and should be the tone of the Panel's report. Mike Leister said that EPA implies that all refineries will comply (i.e., make the investment vs. closing down), and that is not necessarily the case. Some refineries may shut down, while others may choose to produce only higher sulfur fuel. “Compliance” should be defined to capture *all* options, including closing down. Also, refineries may shut down for a multitude of reasons unrelated to the rule, but the rule could be a part of those reasons. No one will choose to shut down only because of this rule but this rule will contribute to the economic analysis. Refineries generally are where they should be, if not ahead. The annual pre-compliance reports provided to EPA will monitor these compliance options as well, and will be helpful in determining refiners' decisions.

Bob Leidich (BP) reminded the group that distribution hurdles still need to be overcome in order to deliver ULSD to consumers. These need to be addressed as part of implementing the 2006 standard. Production of ULSD is not the only goal of the standard; distribution is also a key factor to monitor in the rule's implementation. (This issue may belong under "other issues"). However, the definition of refineries includes producers and distributors. If this issue is not addressed in the report, the third subquestion needs to be clarified that it only deals with the physical refinery. The panel has been asked to deal with the issue specifically of refineries being able to produce ULSD. Paul Billings said that at the second meeting (in June, 2002), EPA announced the workshops. The report should include that there are other venues for addressing these other issues, including distribution.

James Kennedy said there is a general sense that refineries in Europe will produce five ppm S fuel so the fuel leaving the refinery gate will meet 10 ppm, but there is no defined, official specification for fuel production in the U.S. Producers are guessing that 5-8 ppm of sulfur will be necessary to achieve the standard downstream, but the refinery spec has yet to be defined. Dan Greenbaum clarified that in Europe there is no downstream enforcement of the rule. The rule is 10 ppm at the refinery gate. Mike Leister added that consumers assume that the fuel they are buying is exactly what the refineries are producing, but they do not understand issues such as contamination in the pipeline. He indicated that the refinery standard is set by the pipeline—look at enforcement, measurement precision and what happens in the pipeline (contamination). He stated that industry is concerned because they don't know what they have to do, what the specs are, or how much fuel they have to produce to meet the market needs. Refineries must consider issues involving pipeline distribution when calculating the sulfur levels they will produce, and these issues have not been quantified. Many rules prevent individual refiners from resolving and discussing these issues as an industry. Mr. Leister went on to say that individual refiners must make decisions fairly quickly, and each refiner is making different assumptions about sulfur levels, product loss, etc. Some individual companies may communicate, but the pipeline/refinery industry has difficulties in sharing information on these issues. The EPA report said shoot for seven ppm and that is what they'll do. Margo Oge (EPA) said that in the past with fuel standards, EPA was not involved in overseeing fuel distribution - the market addressed this - if there is a new role for the government what is it? Mike Leister said the pipelines are not owned by the refineries. Refineries can't dictate the tests for the pipelines to conduct. EPA needs to monitor the fuel after it reaches the terminal, as well as before the fuel leaves the refinery, and EPA needs to monitor what the terminals and pipelines are planning. Margo Oge asked Mr. Leister to clarify whether he was asking EPA to report on the number of terminals that are planning to handle the ULSD? Mike Leister said the refineries are planning 80 percent (15 ppm) / 20 percent (500 ppm) but if the terminals aren't planning to handle this, the refineries need to produce 100 percent ULSD.

4. *What is the current status of new or improved desulfurization technologies?*

With regard to new technologies, not all of these will be available in time for companies to make decisions to incorporate them for the 2006 deadline. Paul Billings added that there is limited operational experience with some of the new technologies. Bob Schaefer clarified that he doesn't

want to imply that not all of these technologies will be available (e.g., new catalysts will be available).

The Panel members discussed whether the report should include a section *Other Implementation Issues for EPA to Monitor*. Dan Greenbaum clarified that the issues for the retailers are already fast-tracked. Several ideas were proposed with regard to this potential section of the report:

1. A generic statement that says there are other issues (such as implementation issues) EPA is monitoring, instead of making a list of specifics. Individuals or organizations can write letters to EPA raising these issues, but the report should not list them, nor should the Panel attempt to debate what issues should be listed. All Panel members may not agree on what issues are important to list (e.g., some panel members don't believe some of these issues involve EPA, e.g., trading). There is also a basket of issues, like supply, that the Panel was not asked to address.
2. Set up a separate workgroup to bulletize a list of issues, because they are important and should be at least named in the report. It is important for people to recognize that there are important hurdles to be overcome that may not be related to technology. Some of the issues raised may be able to be addressed in question 3, and it is difficult to characterize what issues fall in that question. Listing the other issues is a good compromise. Sally Allen (Gary-Williams Energy Corporation) seconds this idea. It was her understanding at the conclusion of the last meeting that this would be done.
3. Do not list the issues. In the charge, the Panel was not asked the question of what other issues exist. Some members have raised their issues, but some have not in the interest of sticking to the Panel's specific charge. Create categories of other issues instead.
4. The charge was given as a narrow definition of strictly technology issues, but if the report does not address or list these other issues, the public will be given a false impression that everything is "hunky dory." There are no showstoppers right now, but there may be issues unrelated to technology that need to be addressed to ensure successful implementation of the rule. The report should include a warning of these issues.

In 2006-7, the implementation problems will be evident. There are always transitional issues. If problems surface, an "other issues" paragraph in this report won't cut it. It is important to list them so people recognize the real hurdles that need to be overcome to get 15 ppm fuel to the market.

5. Eliminate this section, and only focus on the issues specifically listed in the charge. This Panel should not become a surrogate for EPA's process of dealing with other issues. The Panel could make a laundry list of other issues, but it won't be able to address them. The list could potentially be used to try to reopen the rule.

6. Give anyone the opportunity to identify other issues, but those comments will not be a formal part of the Panel's report. The Panel would not address these issues, but individual members could write letters listing issues outside the Panel.
7. In many comments on the EPA report, members raised other issues unrelated to technology. Include these comments as an appendix to the Panel's report (thereby making it an official part of the report), and reference the appendix in the report when addressing other issues.

Rich Kassel said we've all learned a lot (e.g., the testing issue). There is an ongoing process to address these issues, as well as new issues. EPA is always willing to accept new data or discuss new issues not addressed by the rule. There is a basket of supply issues but EPA has asked for a technology review and not a supply review. This Panel has not been charged with doing anything but addressing the four questions. James Kennedy said the second half of the third question could be construed to include supply. Section V [of the report] is a reasonable alternative to not debating what should be in or out of the report in response to question 3. Bill Becker strongly disagrees with having a separate section for other issues. Agrees to just say there are other issues. Whitman was asked to expand the panel and EPA said no. We have to move on. Supply should not be a part of the report. Bob Leidich said pipeline technology is not currently available to separate transmix, and this is a hurdle that will interfere with the 2006 deadline. The distribution issues could impact the ability of PADD III to deliver up the East Coast. Mike Walsh responded that implementation issues will emerge and that is why there is a lead time. Bill Becker said the report should have an appendix that includes the comments relative to the four questions.

Presentations on Other Issues

- Mike Leister presented "Distribution Tutorial." He explained how different types of fuel must be transported through the pipeline to minimize transmix and protect the fuel. In most cases, a processor picks up transmix at the terminal and ships it back to the refinery. One problem with distributing ULSD is that up to 10 percent of the product can be lost to the transmix. In addition, transmix scenarios vary by pipeline. In terminals that only carry ULSD, they will have no room for transmix. Another problem occurs with protecting ULSD. If ULSD is protected with gasoline, it will create double the amount of transmix.

John Wall asked if water or a solid object could be used to separate fuels. Mr. Leister replied that introducing water would just create more transmix, and pipelines want to avoid introducing a solid object, such as a pipeline inspection gauge (PIG), into a pipeline because it is very labor intensive.

Tim Johnson asked if refiners also own pipelines and/or terminals. Buster Brown (Colonial Pipeline) replied that many scenarios of ownership existed between refineries, pipelines, and terminals. Mr. Johnson asked how many options for moving fuel are available to the refiners. Mr. Brown responded that trucks are always an option. In upper

Michigan there is only one pipeline. From the Gulf Coast to the East Coast there are usually two options but the pipelines are running close to capacity.

The amount of transmix that can be reused depends on the volume of transmix. At Colonial Pipeline, 0.5 percent of the transmix can be blended into the gasoline. Percentages can be misleading, since some pipelines transport extremely high volumes of fuel. For example, the Colonial Pipeline system transports large volumes of fuel, so the percentage of transmix is low, but the actual volume is high.

- Wes Neff gave the presentation “Marathon Ashland Petroleum LLC ULSD Testing.” The company ran a test batch of ULSD in its pipeline from Garyville to Zachary, LA in order to determine potential problems with fuel degradation and sulfur testing. The ULSD was wrapped with LSD (<500 ppm S) and regular gasoline. The results were positive, and indicated that pipelines could transport ULSD with sulfur levels largely intact. In the test trip, sulfur levels increased from 7 ppm to 10 ppm, but Mr. Neff surmised that cleaning the pipe at the refinery would eliminate the problem. Contamination occurred mostly in the refinery piping, little contamination occurred in the pipeline itself. In this test the sulfur and gravity tracked pretty well. However, Mr. Neff stressed the importance of an in-line sulfur testing system to help define cut points and eliminate as much of the transmix as possible. An appropriate test system does not exist at present. The S test method is to determine when to make the cut, consequently, relative S content is more important than absolute S content.

Tim Johnson asked if a colorant could help determine when to cut the ULSD batch. Buster Brown replied that pipelines have had numerous problems in the past with colorants, and they would only use a colorant as a last resort. Currently, dye is added to both high sulfur (off-highway) distillate and jet fuel.

Dan Greenbaum commended Marathon for taking the initiative of testing ULSD distribution, and asked if other companies were running tests. Mike Leister replied that some companies would, and they are seeking government funds.

- Buster Brown gave the presentation “Colonial Pipeline Company: CDIRP Pipeline Issue Review.” Colonial Pipeline ran a similar test to Marathon, but shipped a much larger volume over a longer distance. The test batch ran from Texas to Greensboro, NC, and sulfur levels were tested at the origin, in Atlanta, and in Greensboro. Levels were also taken in local Greensboro terminals, terminals to the north of Greensboro, and in Selma, NC where samples were shipped in tanker trucks. Using the 6428 method, test results showed that sulfur increased to off-spec levels from the Greensboro tanks to Selma. Using the 5453 method, the fuel was off-spec by the time it traveled from the pipeline to the Greensboro tanks. Mr. Brown postulated that contamination could occur from a leaky valve, but they have not investigated contamination sources yet. Other contamination could have occurred from cutting the ULSD batch at the wrong times, which would allow

some high sulfur fuel to mix with the ULSD. Results show that batch cuts based on gravity did not line up with sulfur levels, contrary to Marathon's results. One reason could be the large volume of fuel. A better method is needed to determine when to cut the ULSD batches. Mr. Brown also emphasized a need for in-line sulfur testing.

When asked about a small amount of contamination, Mr. Brown pointed out that the contaminated fuel is the last fuel into the tank. It'll be the first fuel into the truck and may not get blended out.

Tom Cackette asked which companies compete with Colonial. Mr. Brown replied that Plantation Pipelines follow Colonial to North Carolina, and distribute about 30 percent of Colonial's volume north to New York. Both systems are operating near capacity.

Mike Walsh asked about the testing in the pipeline. Colonial ran 400 tests in the line using both 5453 and 6428. Each sample was run three times. Paul Billings asked if their results differed from Marathon's because of the lack of experience in testing, but Mr. Brown feels confident that their methods are robust. Mike Walsh asked if tracers could be used to determine leaks. Mr. Brown replied that detecting leaks was not impossible, only difficult, but he is confident that leaks can and will be repaired. Dan Greenbaum asked how large the market would be for sulfur testing. Mr. Brown replied that depending on cost, the market could be large. Some companies have been developing test methods, but it has been a very low priority. Labs tend to have the technology and they aren't jumping to develop field testing equipment.

Tim Johnson asked if dopants could be use to track the transmix. Mr. Brown replied that there would be no need if the signs of approaching transmix were easily detected. For example, at the head end of the batch, one can look at the volume of fuel, wait about 20,000 barrels, then make a batch cut. At the tail end, if the batch size is known, one could cut the batch with 20,000 barrels to spare. Currently a gravity interface (at Colonial) is about 12,000 bbls.

Tim Johnson observed that the issues presented do not seem to be technological showstoppers, only engineering problems than may result in a high-cost solution. Mr. Brown replied that he is concerned with the large interface size, as well as the unknown sources of contamination.

Mr. Brown mentioned that the only solution to the problems they discovered is to downgrade all of the fuel that may be contaminated to HSD. ULSD and kerosene cannot be shipped together, as they create an incompatible transmix. Everything must be wrapped with HSD in the future, so refineries must produce HSD year-round. Mike Leister commented that many refineries may move to producing more nonroad fuel in order to protect ULSD from the kerosene. High sulfur kerosene (jet fuel) will continue to move through the pipelines. If the nonroad rule imposes lower sulfur standards, many

companies will be hard-pressed to find quick solutions to protecting ULSD. Otherwise, large amounts of interface (HSD) will be wasted. Mr. Brown agreed that under such circumstances, the industry would be dealing with huge supply losses.

James Kennedy asked what size of interface the EPA projected in producing ULSD. Paul Michiele (EPA) said EPA projected double the current amount of interface. However, Mr. Brown pointed out that more accurate measuring techniques could increase the interface size even more.

Mike Leister observed that Colonial shipped a large amount of home heating oil, which enabled them to protect ULSD. However, this is not the case in the Northwest. Those pipelines and terminals do not have the tankage to produce nonroad fuel, so downgrading is not an option. Bob Neufeld agreed that downgrading the fuel may be a short-term solution, but it may not be feasible in the long run.

CLEAN DIESEL INDEPENDENT REVIEW PANEL

Attendees: Members and Alternates

July 30-31, 2002 Arlington, Virginia

Name	Organization
Daniel Greenbaum, Chair	Health Effects Institute
Mary Manners, Designated Federal Official	U.S. EPA
Sally Allen	Gary-Williams Energy Corporation
Loren Beard, alternate for Josephine Cooper	Alliance of Automobile Manufacturers
Bill Becker	STAPPA/ALAPCO
Bruce Bertelsen	Manufacturers of Emission Controls Association
Paul Billings	American Lung Association
Bob Leidich, alternate for Tom Bond	BP
Tom Cackette	State of California Air Resources Board
Pat Charbonneau	International Truck & Engine Corporation
Bill Gouse	American Trucking Associations
Timothy Johnson	Corning, Inc.
Rich Kassel	Natural Resources Defense Council
James Kennedy	UOP LLC
Michael Leister	Marathon Ashland Petroleum LLC
Bob Neufeld	Wyoming Refining Company
Mike Walsh	consultant
John Wall	Cummins
Alan Wright	Pilot Corporation

Attendees: Guest Speakers

Name	Organization
Jon Skeds and Michael Ackerson	Linde Process Plant and Process Dynamics
Jim E. (Buster) Brown	Colonial Pipeline Company
Dennis Kidd	Phillips Petroleum Company
Wes Neff	Marathon Ashland Petroleum, LLC
Bob Schaefer	BP

Attendees: Speakers providing oral comment on EPA report

Name	Organization
Jed Mandel	EMA
Chuck K. Salter	Mack

Attendees: Technical Advisors to the Panel

Name	Organization
Chet France	U.S. EPA
Margo Oge	U.S. EPA

Attendees: Other

Name	Organization
Rebecca Battye	EC/R, Inc. – EPA Contractor Support
Kathy Boyer	EC/R, Inc. – EPA Contractor Support

Attendees: Observers

Name	Organization
Mitch Baer	DOE, Office of Policy
Byron Bunker	EPA
Bill Byrne	Orion Refining
Charlie Drevna	NPRA
John Duerr	Detroit Diesel
Roger Fairchild	Consultant
Marc Goodman	QSS
Jeff Johnson	Transport Topics
Michele Joy	AOPL
Dale Kardos	DKA, Inc.
Yoshihiro Kawaguchi	Mitsubishi Motors
Peter Lidick	API
Maureen Lorensetti	Oil and Gas Journal
Jason Lynn	NATSO
Paul Machiele	EPA
John Medley	ExxonMobil
Doug McGregor	BMW of North America
Marc Mefeyer	API
Kathy Jurado Muñoz	Alcalde & Fay
Gila Murthy	Hogan & Hartson
Frank O'Donnell	Clean Air Trust
Michael Osborne	Navy
Jack Peckham	Hart Energy Publications
Jeff Reumy	Phillips Petroleum
Ichiro Sakai	American Honda
Greg Scott	CSS
John Stanlon	Air Daily
Bob Sussann	Latham & Watkins
Edmond Toy	OMB
Marie Valentine	Toyota
Jim Williams	API
Kevin Williams	DCTLCA
Josh Zahn	AgSource